	Colonization by Invertebrate Indicator Species of River Channel Sandbars
Expectation:	Invertebrate colonization of marginal channel sandbars by at least six (6) indicator species (Table 1).
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Relevant Endpoint(s):	Restoration - Biological Integrity - Community Structure Restoration – Biological Integrity – Colonization Rates Restoration – System Functional Integrity - Habitat Quality Restoration – System Functional Integrity – Habitat Use
Baseline Condition:	Channelization of the Kissimmee River greatly altered the geomorphology of the historic system. Marginal river channel sandbars no longer exist along most of the channelized river.
Reference Condition:	Historical data on macroinvertebrate community structure of marginal channel sandbars are not available for the pre-channelized Kissimmee River. In fact, I am unaware of any data on macroinvertebrate community structure characteristics of marginal channel sandbars. Although marginal channel sandbars will be subjected to different flow regimes than mid-channel benthic habitats, and may be subjected to intermittent drying, it is likely that invertebrate species composition on marginal channel sandbars will be similar to adjacent mid-channel benthic habitats; however, larger taxa not typical of mid-channel benthic habitats (e.g., odonates and mollusks) also are likely to colonize marginal sandbars (J.W. Koebel Jr., personal observation). Reference conditions for species composition of marginal channel sandbars were derived from literature on habitat preferences and distributions of aquatic invertebrates (Heard 1979; Dunkle 1989; Epler 1992; Pescador et al. 1995), and from data collected from marginal river channel sandbars within revitalized channels of Pool B (J.W. Koebel Jr., personal observation). Table 1 lists indicator taxa occurring within marginal channel sandbar habitats of Pool B, and other indicator taxa likely to colonize restored sandbars.
Mechanism Relating Restoration To Reference Conditions:	Restoration of continuous, variable flow through remnant river channels is expected to flush accumulated organic matter from river channels and redistribute sand substrate to form sandbars along inside margins of meanders. Restoration of habitat is dependent on discharge and duration of flow. Restoration of invertebrate biota will be a function of colonization rates, after sandbars have been reestablished. Colonization is likely to occur through adult oviposition and downstream transport (drift) of larvae. Many expected colonists including chironomids, dragonflies, mayflies, and bivalves occur within the partially revitalized channels of Pool B and other portions of the Kissimmee basin.
Time Course for Restoration:	Habitat restoration will be linked to discharge patterns and duration of flow. Results of the Demonstration Project (Toth 1991) indicate that

average daily discharges between 11 and 41 cms were sufficient to flush remnant river channels and form sandbars. It is likely that variable discharge patterns will restore marginal river channel sandbars within 12 months following initiation of the upper basin regulation schedule.

Restoration of sandbar invertebrate biota will be a function of colonization rates once sandbars have been reestablished. Colonization by some taxa will be rapid. Chironomids are likely to colonize within 90 days, followed by mayflies and dragonflies within six to 12 months. Other larger taxa including clams and mussels likely will colonize within 1 – 2 years.

Adjustments for External Constraints:

Corbicula fluminea, an exotic freshwater bivalve, dispersed widely throughout the southeast United States in the 1960s and 1970s (Counts 1986), and was first recorded from Florida in 1964 (Heard 1964). Densities of *Corbicula* within remnant channels of the Kissimmee River are low (J.W. Koebel Jr., personal observation); however, maximum mean density can exceed $1000/m^2$ in blackwater river systems (Stites et al. 1995; Toth 1991). Densities of *Corbicula* are expected to remain low within the Kissimmee River and this taxon is not expected to displace any native bivalves or play a major role in the trophic dynamics of the restored system.

All indicator taxa likely to colonize restored marginal channel sandbars occur within the Kissimmee – Okeechobee ecosystem; therefore, there are no external constraints which would delay or preclude restoration of the biotic component of this habitat.

Means of Evaluation:

Sampling of marginal channel sandbars will commence ~ 6 months following formation. Methods will include monthly collection of replicate (5, minimally) "stovepipe" (area = 0.105 m^2) samples from randomly selected submerged sandbar locations within the restored area. The specific location on the sandbar where samples are collected (e.g., distance from shore and approximate distance from channel drop-off) and percent of inundated sandbar also will be recorded to explain potential variability in macroinvertebrate abundance or biomass associated with seasonal depth, flow, and inundation patterns. Samples will be analyzed for invertebrate species composition, species richness, number of indicator species, mean annual density, mean standing stock biomass, and functional feeding group composition for each taxon. Results will be compared to the stated expectation. The expectation will be achieved once at least six epipsammic indicator taxa have been identified from newly formed sandbars.

REFERENCES

Anderson, D.H., J.W. Koebel, Jr., and L.M. Rojas. 1998. Pre-restoration assessment of aquatic invertebrate community structure in the Kissimmee River, Florida. Final deliverable (C-6625) to the South Florida Water Management District, West Palm Beach, FL.

Benke, A.C., T.C. Van Arsdall, Jr, and D.M. Gillespie. 1984. Invertebrate productivity in a subtropical blackwater river: the importance of habitat and life history. Ecological Monographs 54:25-63.

Berner, L. and M.L. Pescador. 1988. The Mayflies of Florida. University Presses of Florida. Gainesville, Florida.

Counts, C.L. 1986. The zoogeography and history of the invasion of the United States by *Corbicula fluminea* (Bivalvia: Corbiculidae). American Malacological Bulletin. Special Edition No. 2:7-39.

Dunkle, S.W. 1989. Dragonflies of the Florida peninsula, Bermuda and the Bahamas. Scientific Publishers. Gainesville, Florida.

Epler, J.H. 1992. Identification manual for the larval Chironomidae (Diptera) of Florida. Florida Department of Environmental Regulation. Tallahassee, Florida.

Heard, W.H. 1964. *Corbicula fluminea* in Florida. Nautilus 77:105-107.

Heard, W.H. 1979. Identification manual of the freshwater clams of Florida. Technical Series, Volume 4. Department of Environmental Regulation. Tallahassee, Florida.

Merritt, R.W., J.R. Wallace, M.J. Higgins, M.K. Alexander, M.B. Berg, W.T. Morgan, K.W. Cummins, and B. Vandeneeden. 1996. Procedures for the functional analysis of invertebrate communities of the Kissimmee River – floodplain ecosystem. Florida Scientist 59:216-274.

Pescador, M.L., A.K. Rasmussen, and S.C. Harris. 1995. Identification manual for the caddisfly (Trichoptera) larvae of Florida. Florida Department of Environmental Protection. Tallahassee, Florida.

Toth, L.A. 1991. Environmental responses to the Kissimmee River demonstration project. Technical Publication 91-02. South Florida Water Management District. West Palm Beach, Florida.

Smock, L.A., E. Gilinsky, and D.L. Stoneburner. 1985. Macroinvertebrate production in a southeastern United States blackwater stream. Ecology 66:1491-1503.

Stites, D.L., A.C. Bemke, and D.M. Gillespie. 1995. Population dynamics, growth, and production of the

Asiatic clam,*Corbicula fluminea*, in a blackwater river. Canadian Journal of Fisheries and Aquatic Sciences 52:425-437.

Table 1: Common indicator macroinvertebrate taxa likely to colonize marginal channel sandbar habitats of the restored Kissimmee River.

Taxa	Location/Distribution	Reference
Diptera:		
Chironomidae:		
Corynoneura sp.	Kissimmee Basin**	Epler 1992; Merritt et al. 1996
Paracladopelma sp.	Kissimmee Basin**	Epler 1992; Merritt et al. 1996
Psuedochironomus sp.	Kissimmee Basin*	Epler 1992; Merritt et al. 1996
Polypedilum sp.	Kissimmee Basin*	Merritt et al. 1996
Robackia sp.	Kissimmee Basin**	Epler 1992; Merritt et al. 1996
Tanytarsus sp.	Kissimmee Basin**	Merritt et al. 1996
Stictochironomus sp.	Kissimmee Basin**	Epler 1992; Merritt et al. 1996
Ceratopoginidae:		
Palpomyia group	Kissimmee Basin**	Merritt et al. 1996
Ephemeroptera:		
Heptageniidae:		
Stenonema exiguum	Highlands Co., FL	Berner & Pescador 1988
Caenidae:		
Cercobrachys etowah	Highlands Co., FL	Berner & Pescador 1988
Mollusca:		
Sphaeriidae:		
Corbicula fluminea	Kissimmee River	Toth 1991
Musculium transversum	Kissimmee River	Toth 1991
Pisidium casteranum	Kissimmee River	Toth 1991
Unionidae:		
Popenaias (*Elliptio*) *buckleyi*	Kissimmee River	Toth 1991
Anodonta couperiana	Kissimmee River	Anderson et al. 1998
Anodonta imbecilis (?)	Kissimmee River	Anderson et al. 1998
Odonata:		
Gomphidae:		
Gomphus minutus	Peninsular Florida	Dunkle 1989
Gomphus dialatus	Peninsular Florida	Dunkle 1989
Trichoptera:		
Leptoceridae:		
Nectopsyche exquisita	Highlands Co., FL	Pescador et al. 1995

* Known to occur within the Kissimmee Basin.
** Likely to occur within the Kissimmee Basin.